(4) Align the test probe specified in §572.36(a) so that at impact its longitudinal centerline coincides within .5 degree of a horizontal line in the dummy's midsagittal plane.

(5) Impact the thorax with the test probe so that the longitudinal centerline of the test probe falls within 2 degrees of a horizontal line in the dummy midsagittal plane at the moment of impact.

(6) Guide the probe during impact so that it moves with no significant lateral, vertical, or rotational movement.

(7) Measure the horizontal deflection of the sternum relative to the thoracic spine along the line established by the longitudinal centerline of the probe at the moment of impact, using a potentiometer (ref. drawing 78051–317, revision A) mounted inside the sternum as shown in drawing 78051–89, revision I.

(8) Measure hysteresis by determining the ratio of the area between the loading and unloading portions of the force deflection curve to the area under the loading portion of the curve.

[51 FR 26701, July 25, 1986, as amended at 53 FR 8765, Mar. 17, 1988; 62 FR 27518, May 20, 1997; 63 FR 53851, Oct. 7, 1998]

§ 572.35 Limbs.

(a) The limbs consist of the following assemblies: leg assemblies 86–5001–001, revision A and –002, revision A, and arm assemblies 78051–123, revision D and –124, revision D, and shall conform to the drawings subtended therein.

(b) *Femur impact response.* (1) When each knee of the leg assemblies is impacted in accordance with paragraph (b)(2) of this section, at 6.9 ft/sec ±0.10 ft/sec by the pendulum defined in §572.36(b), the peak knee impact force, which is a product of pendulum mass and acceleration, shall have a minimum value of not less than 1060 pounds and a maximum value of not more than 1300 pounds.

(2) *Test procedure.* (i) The test material consists of leg assemblies (86–5001–001, revision A) left and (–002, revision A) right with upper leg assemblies (78051–46) left and (78051–47) right removed. The load cell simulator (78051–319, revision A) is used to secure the knee cap assemblies (79051–16, revision B) as shown in Figure 24.

(ii) Soak the test material in a test environment at any temperature between 66 degrees F to 78 degrees F and at a relative humidity from 10% to 70% for a period of at least four hours prior to its application in a test.

(iii) Mount the test material with the leg assembly secured through the load cell simulator to a rigid surface as shown in Figure 24. No contact is permitted between the foot and any other exterior surfaces.

(iv) Place the longitudinal centerline of the test probe so that at contact with the knee it is collinear within 2 degrees with the longitudinal centerline of the femur load cell simulator.

(v) Guide the pendulum so that there is no significant lateral, vertical or rotational movement at time zero.

(vi) Impact the knee with the test probe so that the longitudinal centerline of the test probe at the instant of impact falls within .5 degrees of a horizontal line parallel to the femur load cell simulator at time zero.

(vii) Time zero is defined as the time of contact between the test probe and the knee.

(c) *Hip joint-femur flexion.* (1) When each femur is rotated in the flexion direction in accordance with paragraph (c)(2) of this section, the femur torque at 30 deg. rotation from its initial horizontal orientation will not be more than 70 ft-lbf, and at 150 ft-lbf of torque will not be less than 40 deg. or more than 50 deg.

(2) Test procedure. (i) The test material consists of the assembled dummy, part No. 78051–218 (revision S) except that (1) leg assemblies (86–5001–001 and 002) are separated from the dummy by removing the 3/8–16 Socket Head Cap Screw (SHCS) (78051–99) but retaining the structural assembly of the upper legs (78051–43 and –44), (2) the abdominal insert (78051–52) is removed and (3) the instrument cover plate (78051–13) in the pelvic bone is replaced by a rigid pelvic bone stabilizer insert (Figure 25a) and firmly secured.

(ii) Seat the dummy on a rigid seat fixture (Figure 25) and firmly secure it to the seat back by bolting the stabilizer insert and the rigid support device (Figure 25b) to the seat back of the test fixture (Figures 26 and 27) while

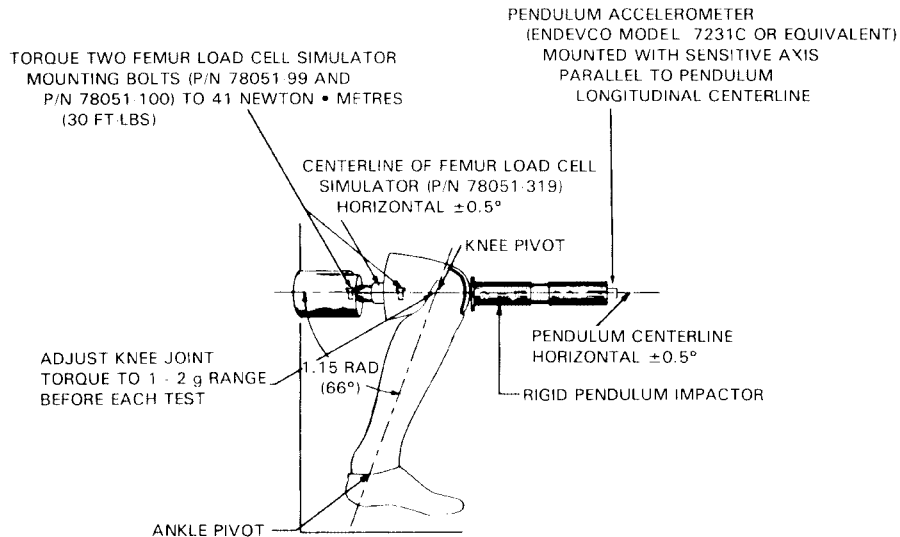maintaining the pelvis (78051–58) "B" plane horizontal.

(iii) Insert a lever arm into the femur shaft opening of the upper leg structure assembly (78051–43/44) and firmly secure it using the 3/8–16 socket head cap screws.
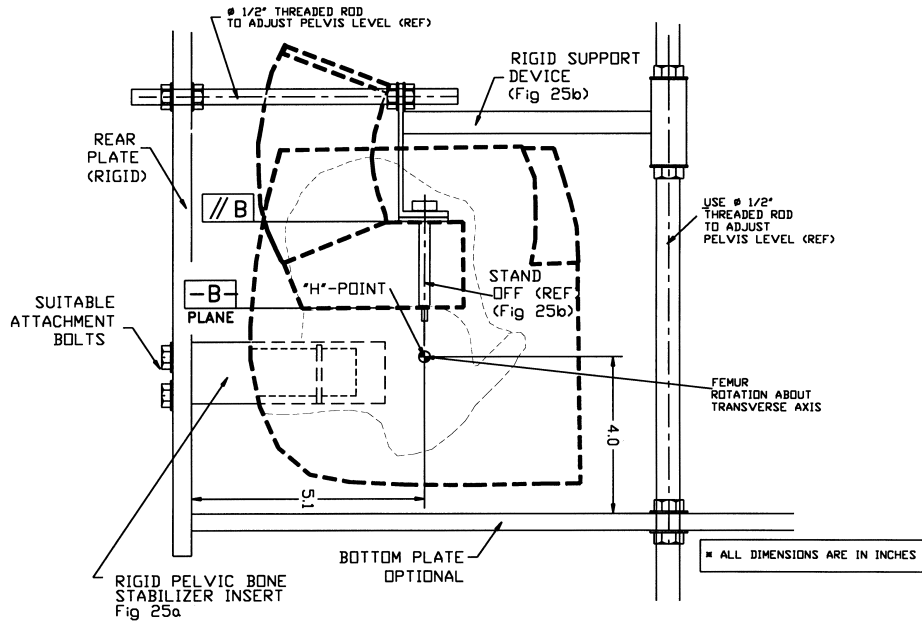
(iv) Lift the lever arm parallel to the midsagittal plane at a rotation rate of 5 to 10 deg. per second while maintaining the 1/2 in. shoulder bolt longitudinal centerline horizontal throughout the range of motion until the 150 ft–lbf torque level is reached. Record the torque and angle of rotation of the femur.
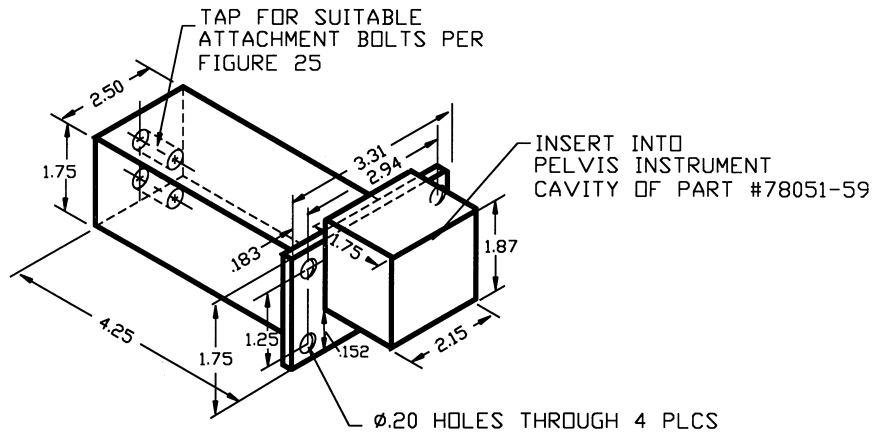
(v) Operating environment and temperature are the same as specified in paragraph (b)(2)(ii) of this section.

FIGURE 24

TEST SET-UP SPECIFICATIONS

PENDULUM ACCELEROMETER
(ENDEVCO MODEL 7231C OR EQUIVALENT)
MOUNTED WITH SENSITIVE AXIS
PARALLEL TO PENDULUM
LONGITUDINAL CENTERLINE

TORQUE TWO FEMUR LOAD CELL SIMULATOR
MOUNTING BOLTS (P/N 78051-99 AND
P/N 78051-100) TO 41 NEWTON • METRES
(30 FT-LBS)

CENTERLINE OF FEMUR LOAD CELL
SIMULATOR (P/N 78051-319)
HORIZONTAL ±0.5°

KNEE PIVOT

ADJUST KNEE JOINT
TORQUE TO 1 - 2 g RANGE
BEFORE EACH TEST

1.15 RAD
(66°)

PENDULUM CENTERLINE
HORIZONTAL ±0.5°

RIGID PENDULUM IMPACTOR

ANKLE PIVOT

HIP-JOINT TEST FIXTURE ASSEMBLY (REF)
Fig 25

TAP FOR SUITABLE
ATTACHMENT BOLTS PER
FIGURE 25

2.50

1.75

3.31
2.94

INSERT INTO
PELVIS INSTRUMENT
CAVITY OF PART #78051-59

1.87

.183

4.25

1.75

1.75

1.25

.152

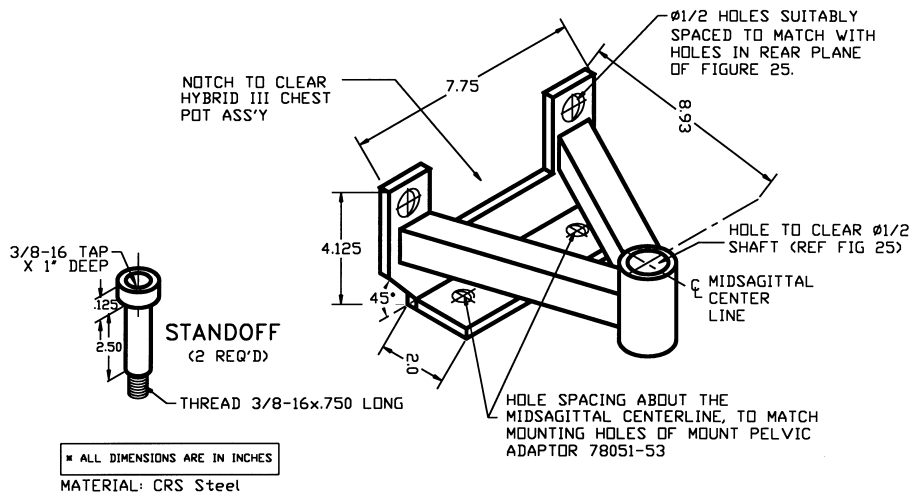2.15

Ø.20 HOLES THROUGH 4 PLCS

* ALL DIMENSIONS ARE IN INCHES

MATERIAL: Alum. or Steel

(REF NOTE): HOLE LOCATIONS MATCHING
INSTRUMENT CAVITY COVER #78051-13
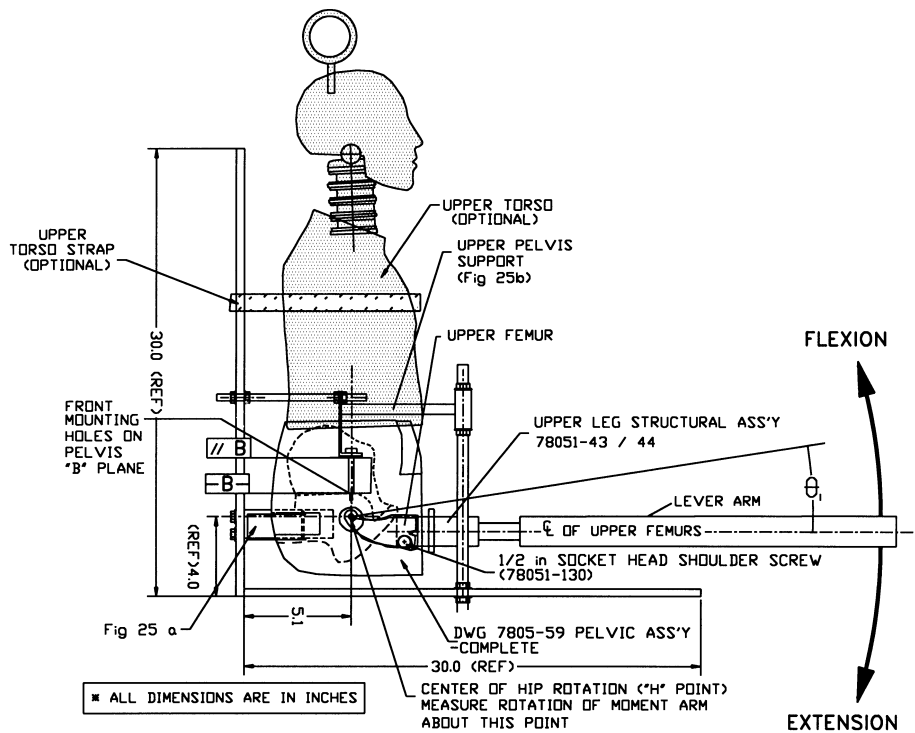
PELVIC BONE STABILIZER INSERT (REF)
Fig 25a

Ø1/2 HOLES SUITABLY
SPACED TO MATCH WITH
HOLES IN REAR PLANE
OF FIGURE 25.

NOTCH TO CLEAR
HYBRID III CHEST
POT ASS'Y

7.75

8.93

3/8-16 TAP
X 1" DEEP

.125

2.50

STANDOFF
(2 REQ'D)

4.125

45°

.2.0

HOLE TO CLEAR Ø1/2
SHAFT (REF FIG 25)

MIDSAGITTAL
CENTER
LINE

THREAD 3/8-16x.750 LONG

HOLE SPACING ABOUT THE
MIDSAGITTAL CENTERLINE, TO MATCH
MOUNTING HOLES OF MOUNT PELVIC
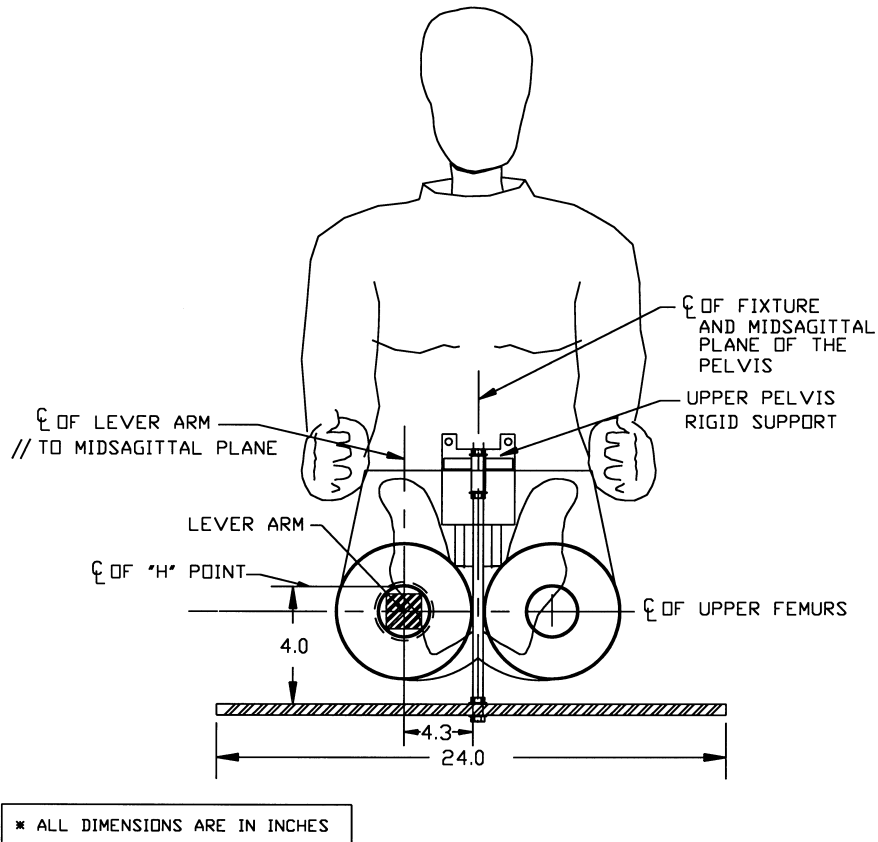ADAPTOR 78051-53

* ALL DIMENSIONS ARE IN INCHES

MATERIAL: CRS Steel

PELVIS UPPER SUPPORT DEVICE (REF)
Fig 25b

HIP JOINT TEST FIXTURE AND TORSO ASSEMBLY (REF)
SIDE VIEW

Fig 26

Ȼ OF FIXTURE
AND MIDSAGITTAL
PLANE OF THE
PELVIS

Ȼ OF LEVER ARM
// TO MIDSAGITTAL PLANE

UPPER PELVIS
RIGID SUPPORT

LEVER ARM

Ȼ OF "H" POINT

Ȼ OF UPPER FEMURS

4.0

4.3

24.0

✱ ALL DIMENSIONS ARE IN INCHES

HIP JOINT TEST FIXTURE AND TORSO ASSEMBLY (REF)
FRONT VIEW

Fig 27

§ 572.36 Test conditions and instrumentation.

(a) The test probe used for thoracic impact tests is a 6 inch diameter cylinder that weighs 51.5 pounds including instrumentation. Its impacting end has a flat right angle face that is rigid and has an edge radius of 0.5 inches. The test probe has an accelerometer mounted on the end opposite from impact with its sensitive axis colinear to the longitudinal centerline of the cylinder.

(b) Test probe used for the knee impact tests is a 3 inch diameter cylinder that weights 11 pounds including instrumentation. Its impacting end has a flat right angle face that is rigid and has an edge radius of 0.02 inches. The test probe has an accelerometer mounted on the end opposite from impact with its sensitive axis colinear to the longitudinal centerline of the cylinder.